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(54) **SCREW ANCHORED ORTHODONTIC APPLIANCE AND METHODS**

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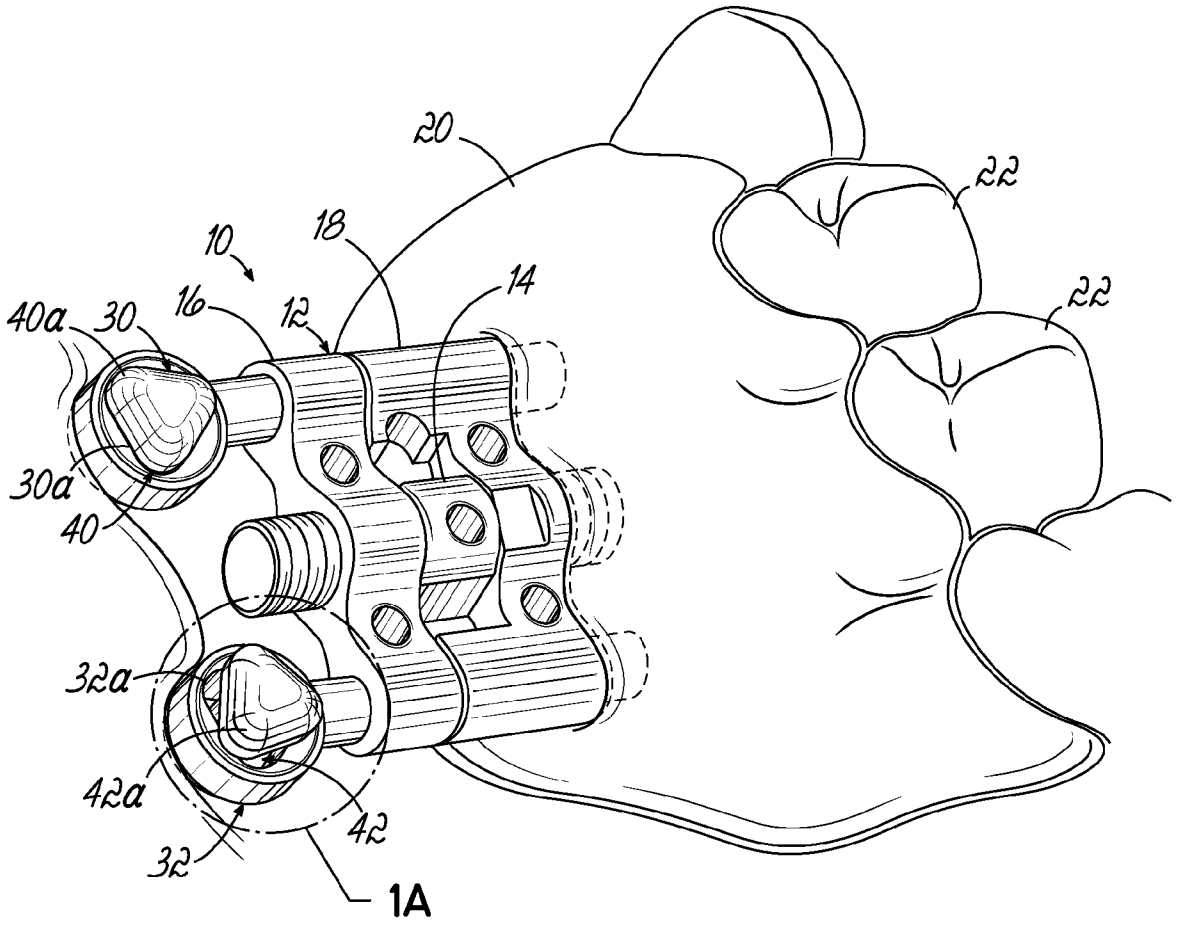
(52) **U.S. Cl.** **433/174**; 433/215

(57) **ABSTRACT**

An orthodontic appliance for correcting malocclusions including a device having first and second operating components, at least one of the operating components configured to be coupled to at least one tooth of a patient. The operating components are coupled together in a manner allowing controlled movement of at least one of the operating components for purposes of correcting the malocclusion. A connector element includes an eyelet coupled to at least one of the first or second operating components, and an orthodontic screw includes a threaded portion and a head. The connector element may be removed from the screw while the threaded portion remains implanted in skeletal structure of a patient.



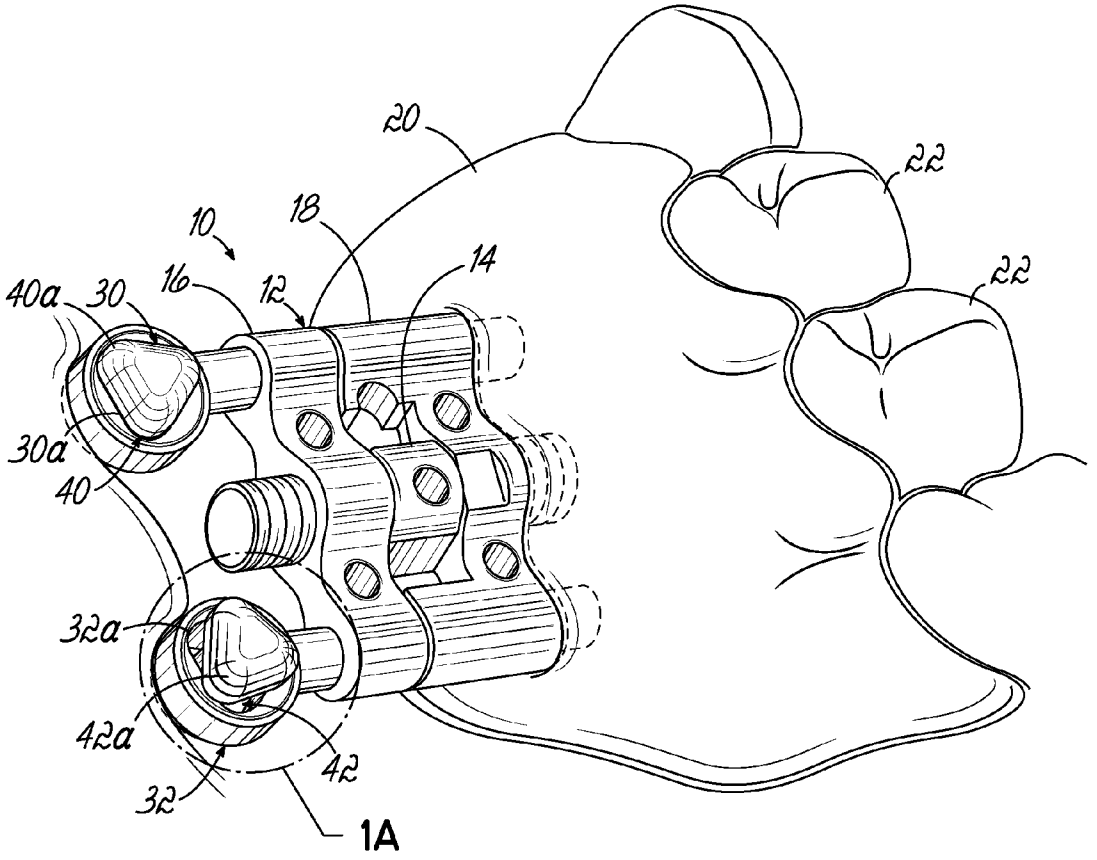


FIG. 1

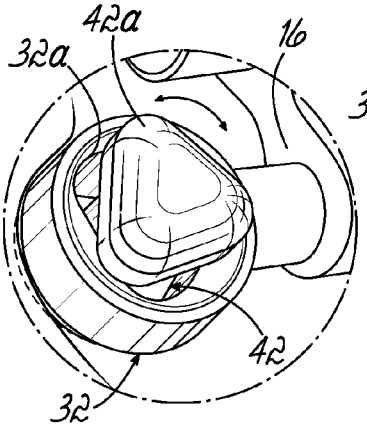


FIG. 1A

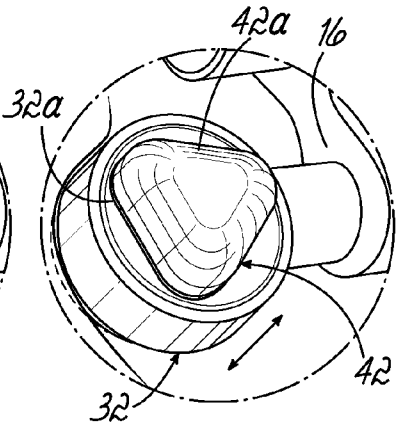


FIG. 1B

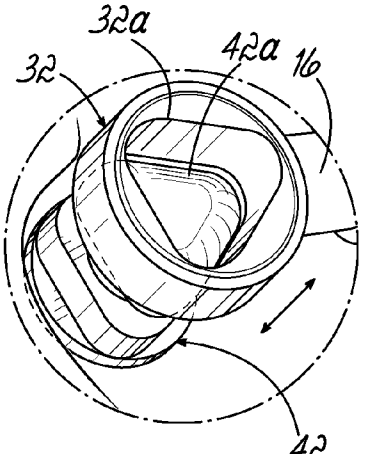


FIG. 1C

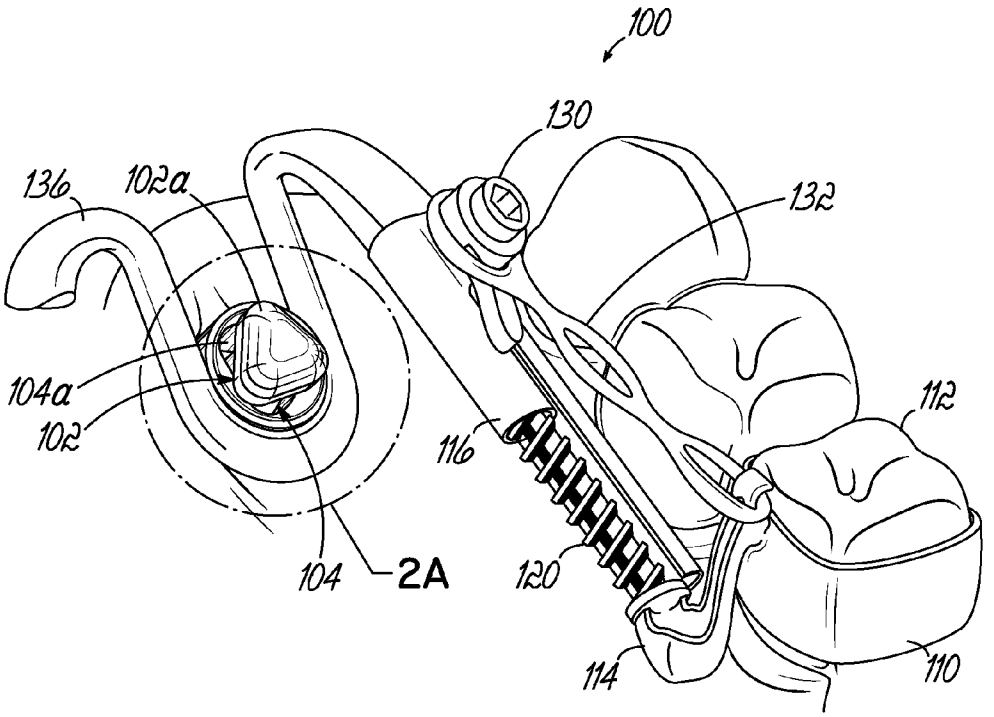


FIG. 2

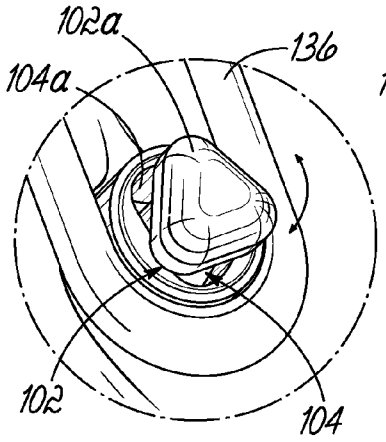


FIG. 2A

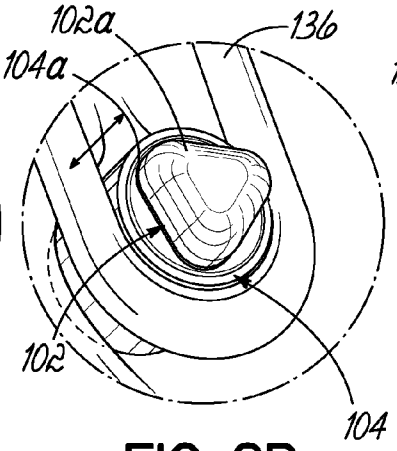


FIG. 2B

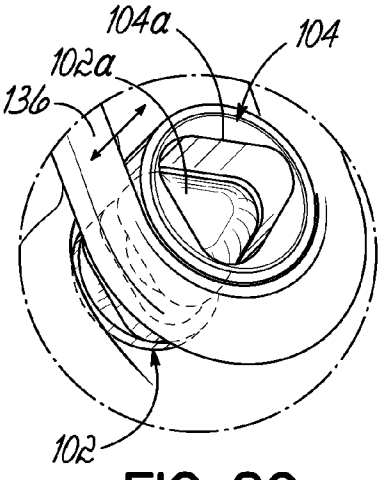


FIG. 2C

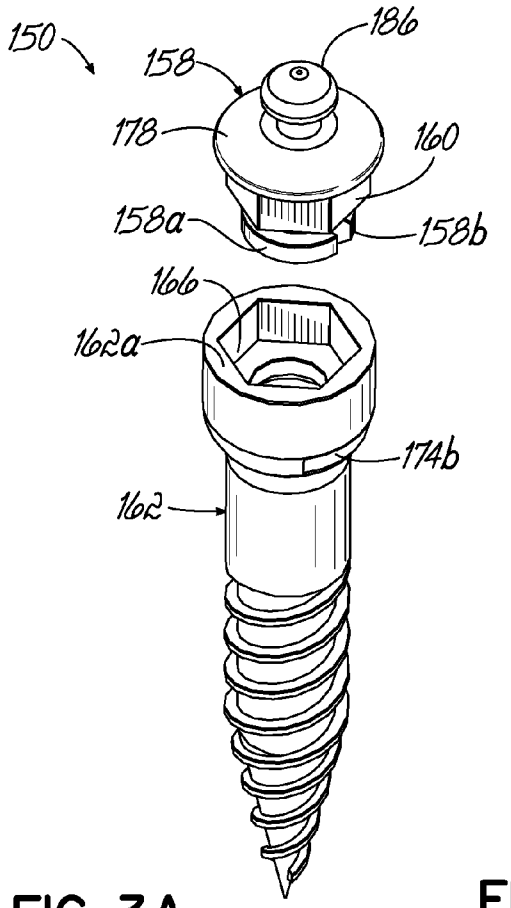


FIG. 3A

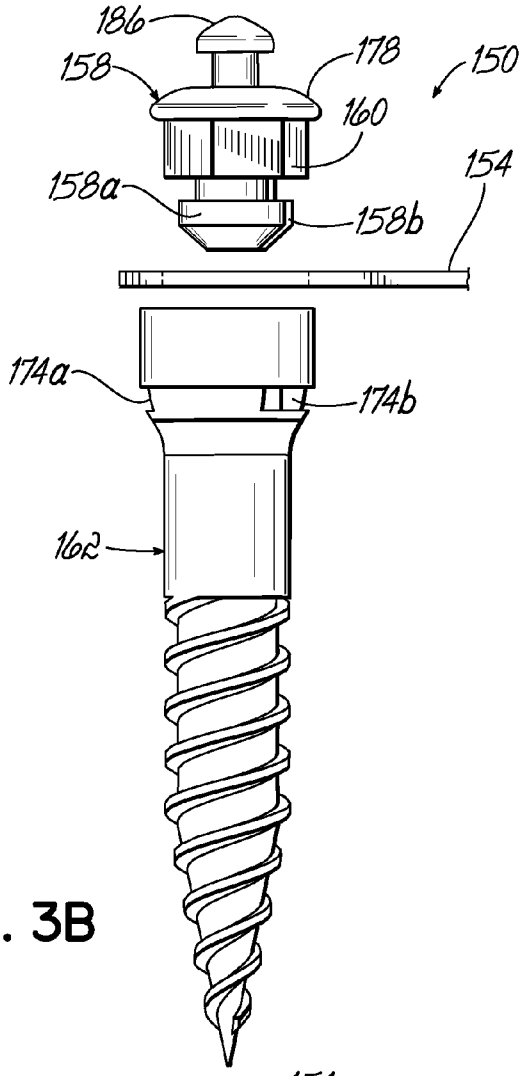


FIG. 3B

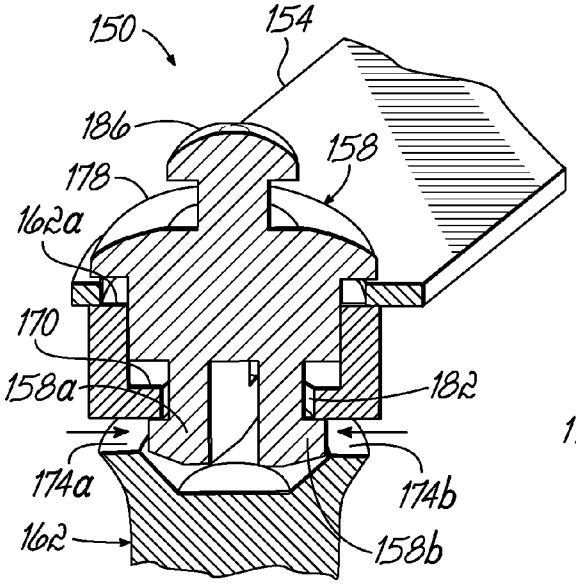


FIG. 3C

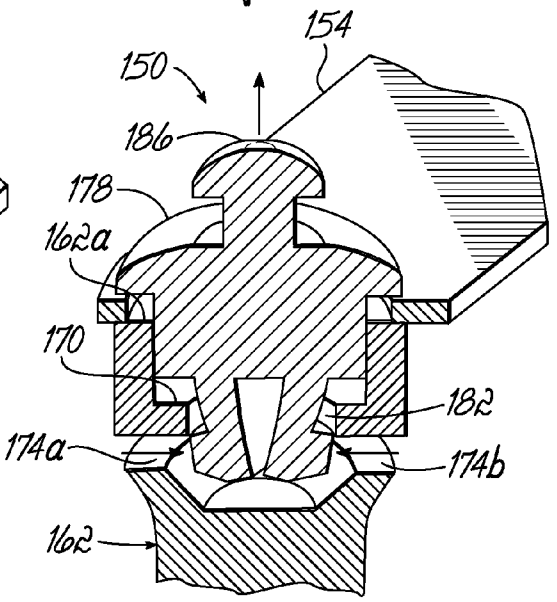


FIG. 3D

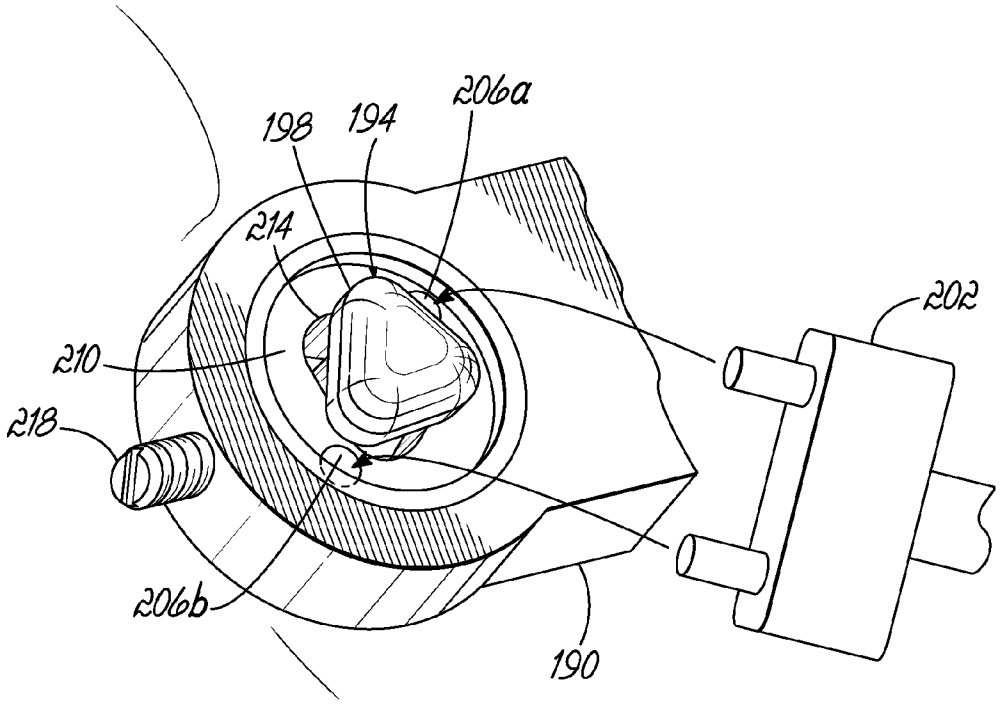

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FIG. 4

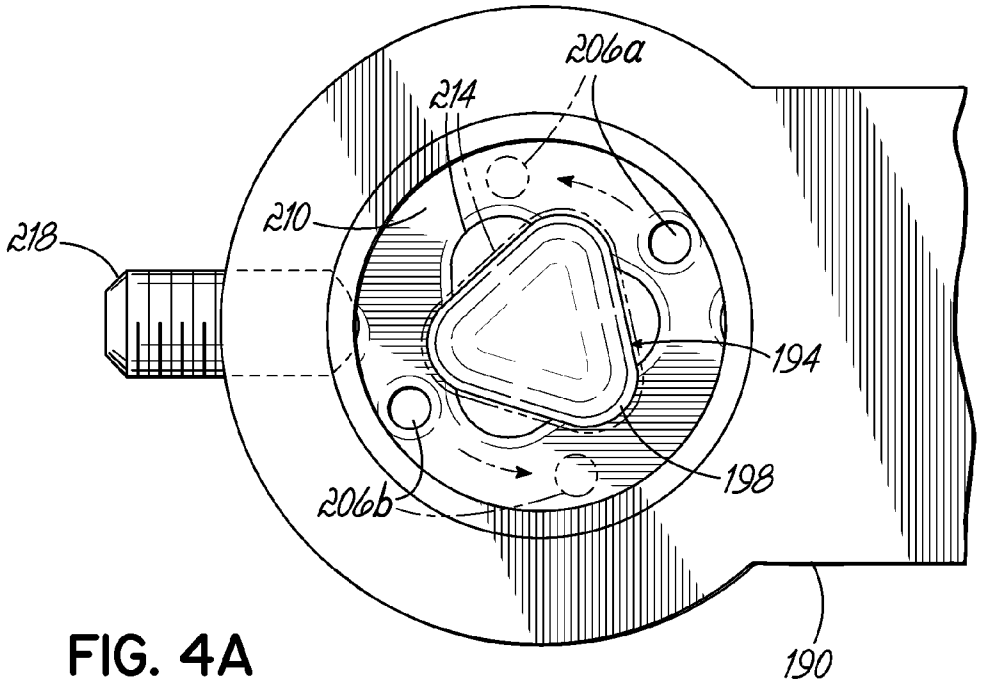
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FIG. 4A

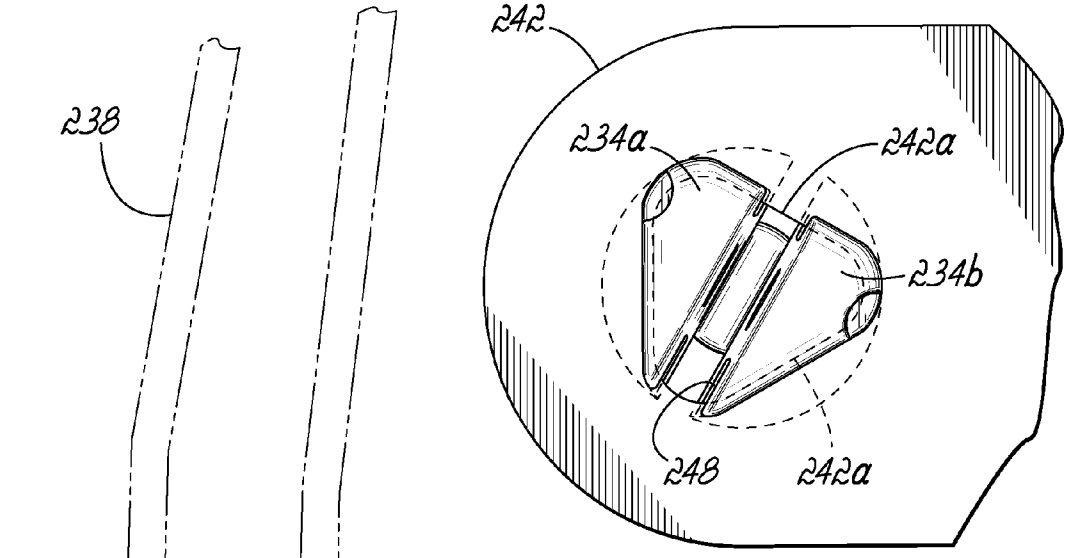

FIG. 5B

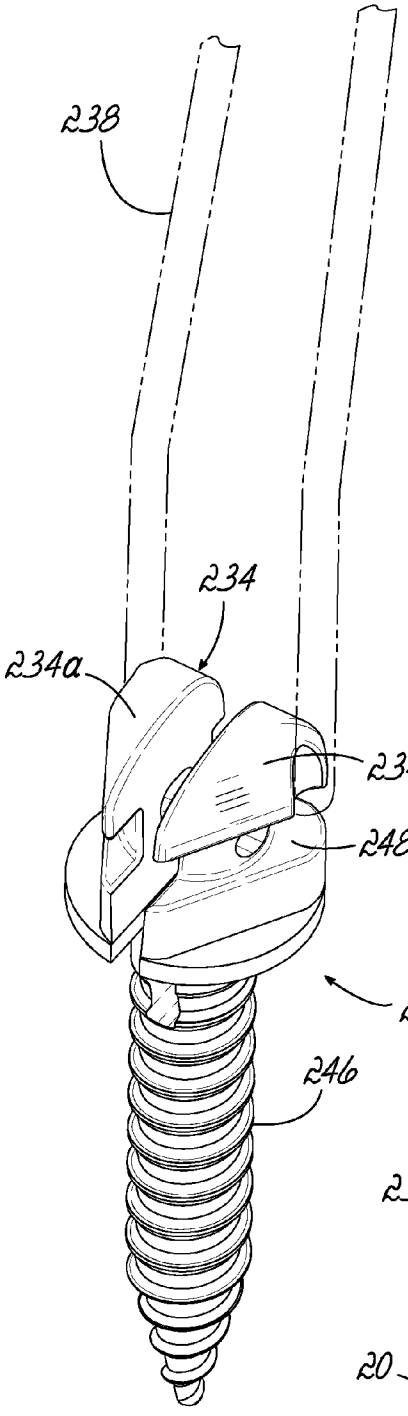

FIG. 5A

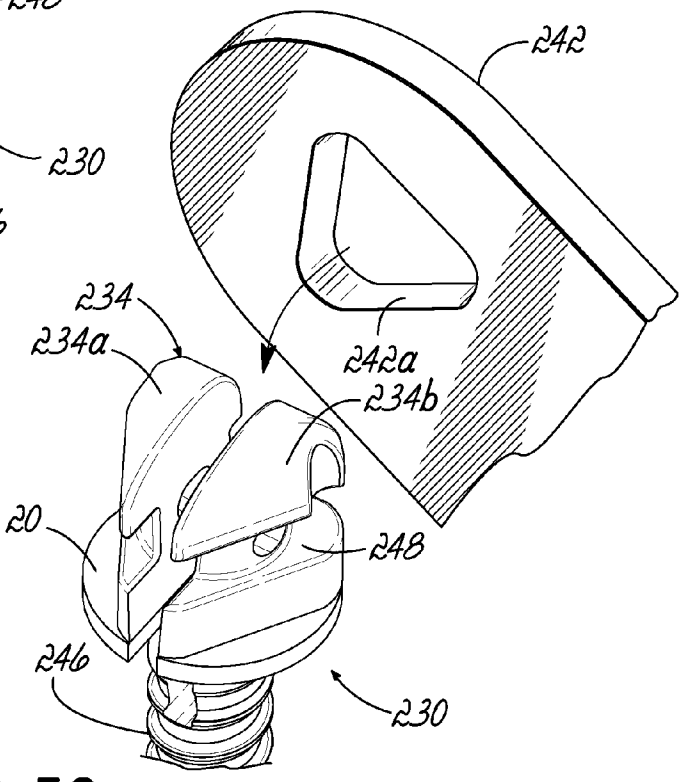

FIG. 5C

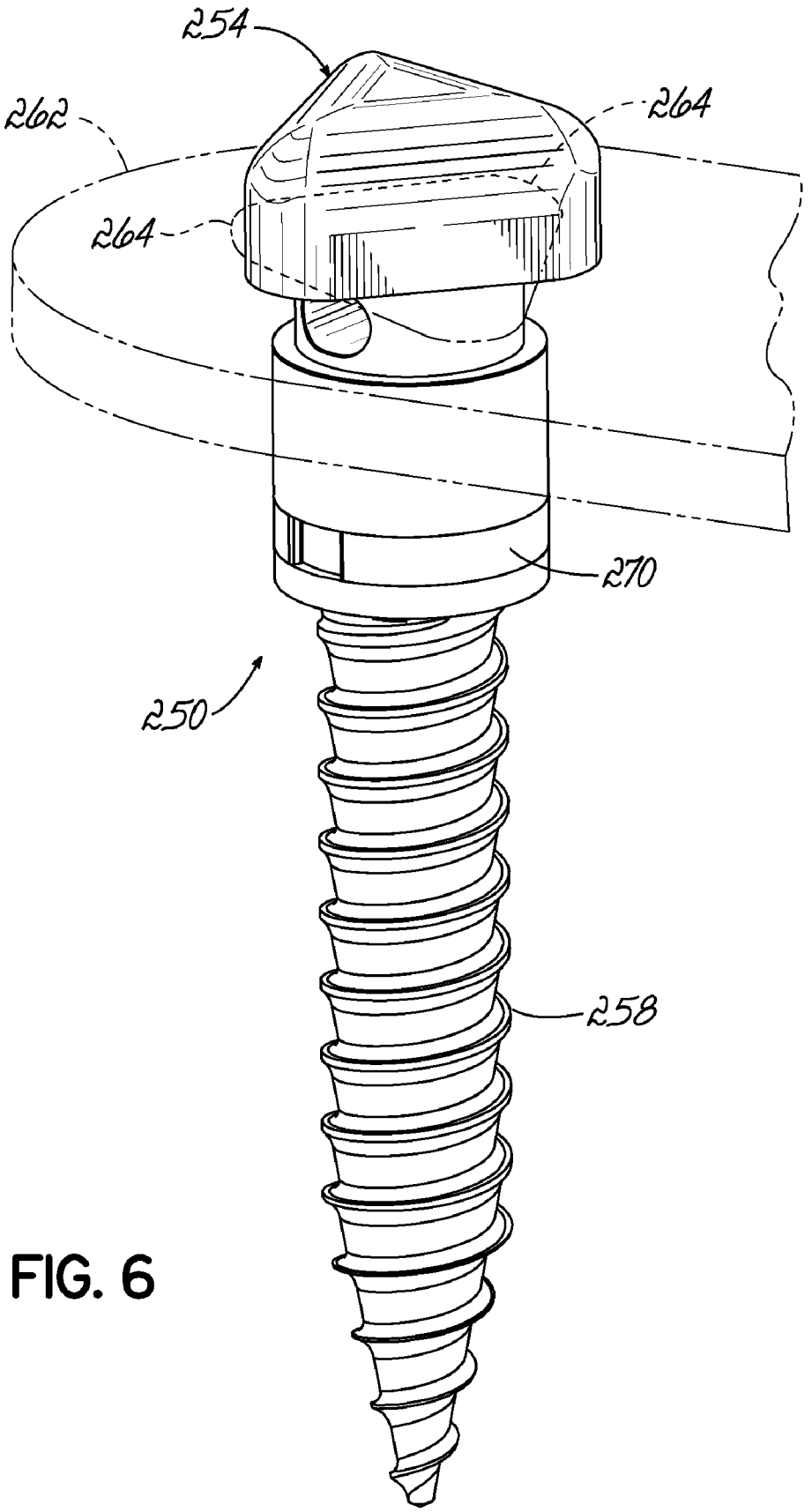

FIG. 6

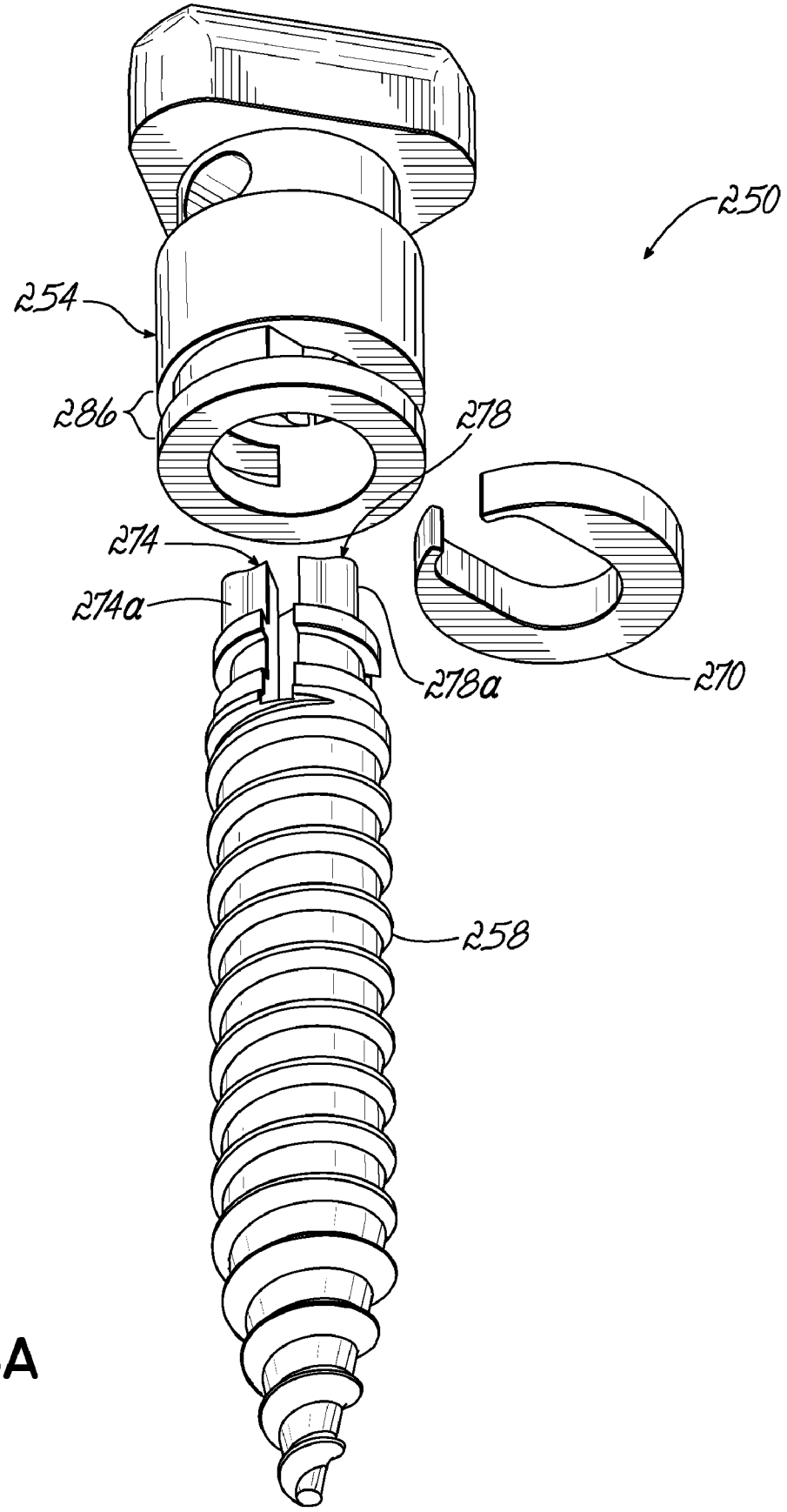

FIG. 6A

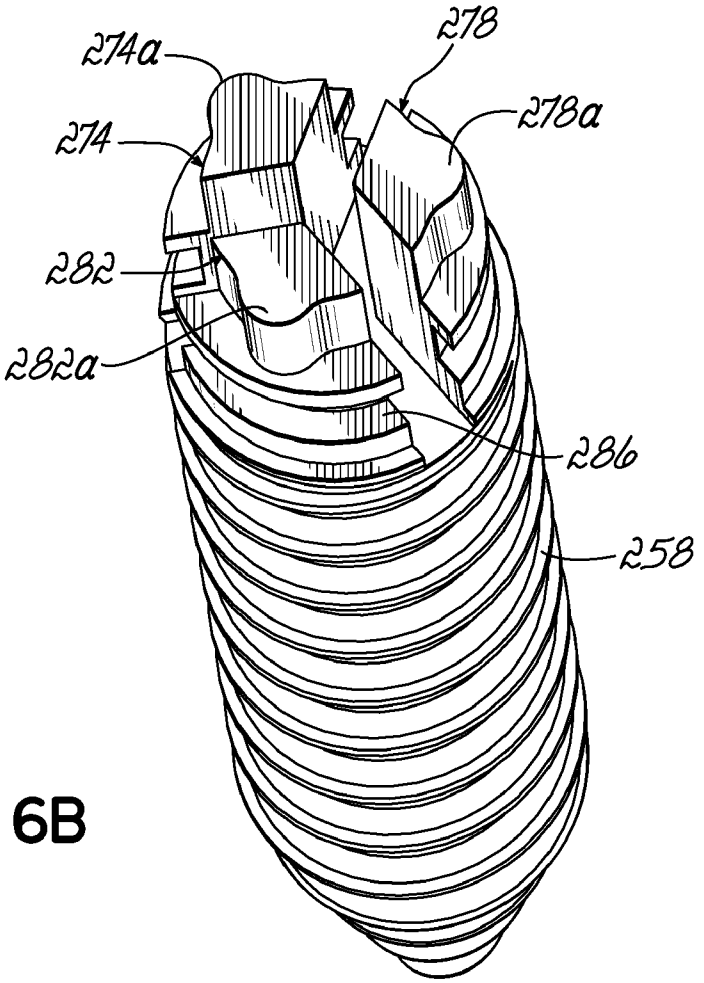
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FIG. 6B

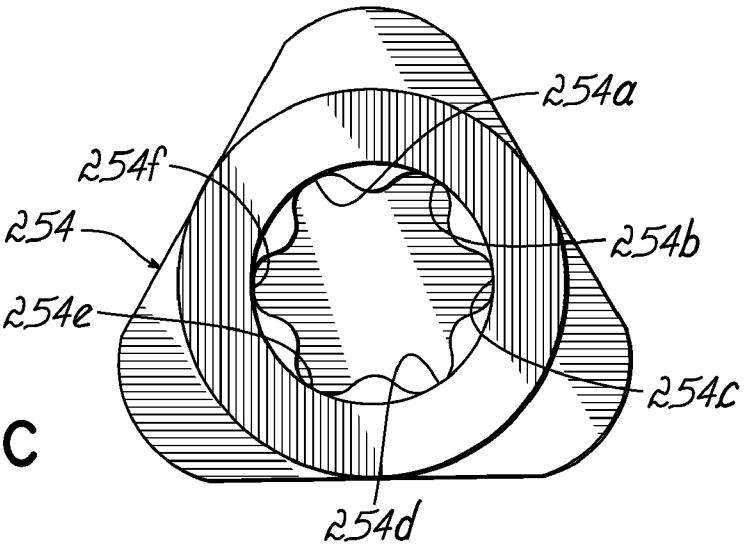
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FIG. 6C

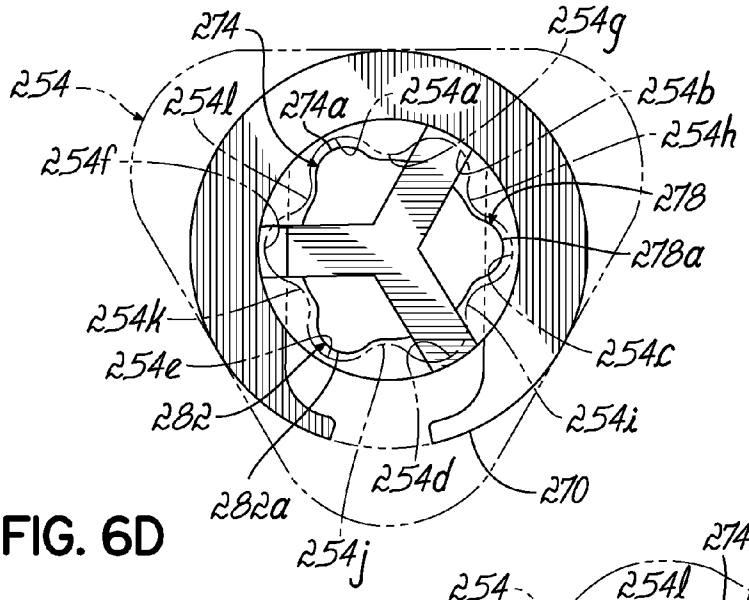

FIG. 6D

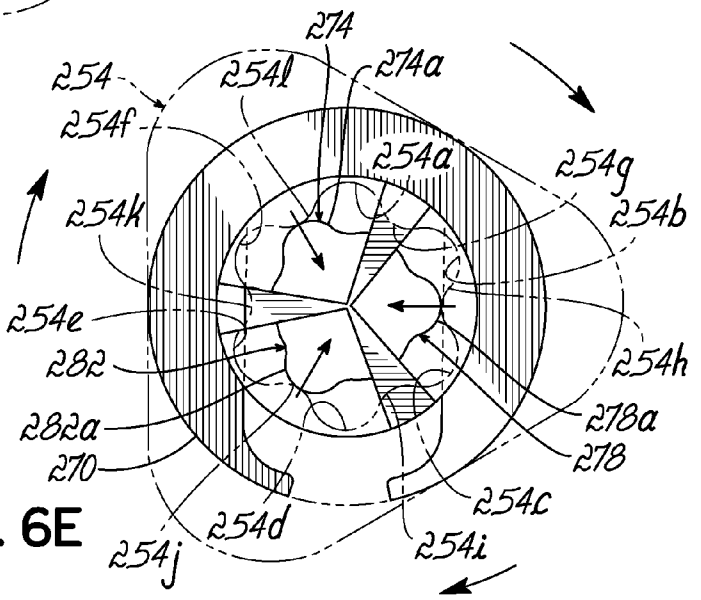

FIG. 6E

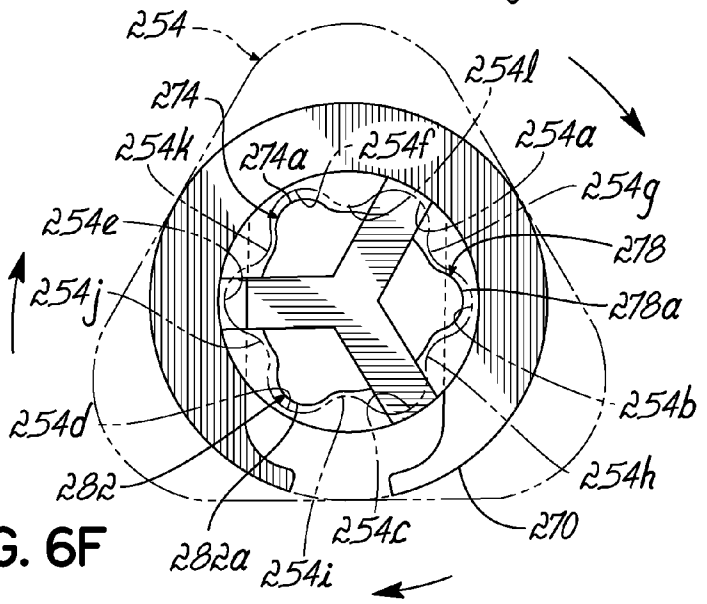

FIG. 6F

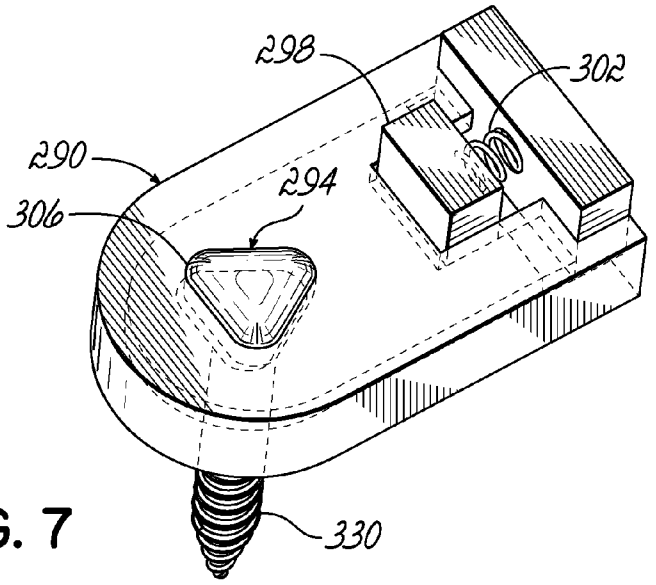

FIG. 7

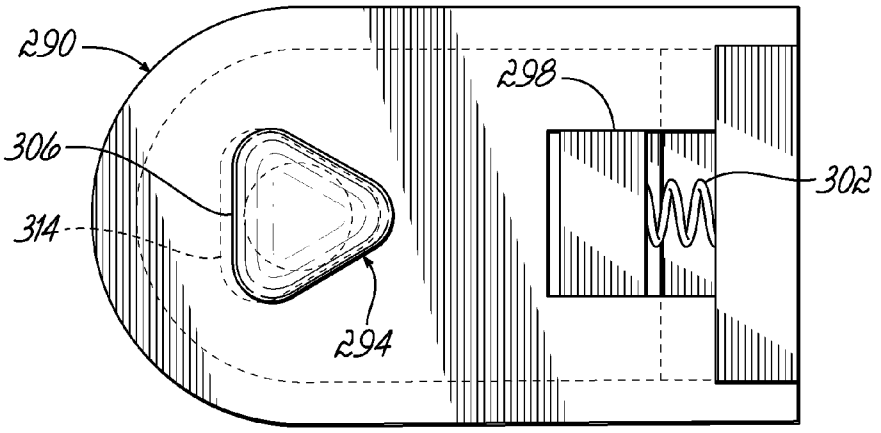

FIG. 7A

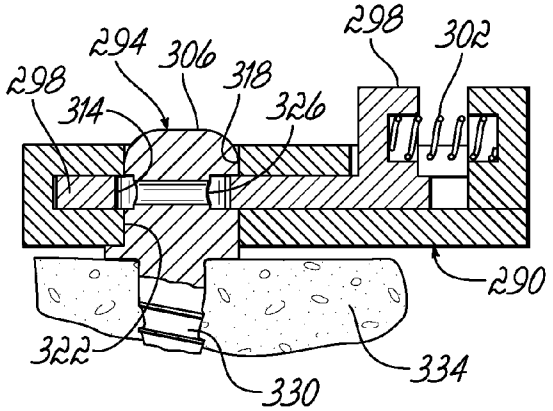

FIG. 7B

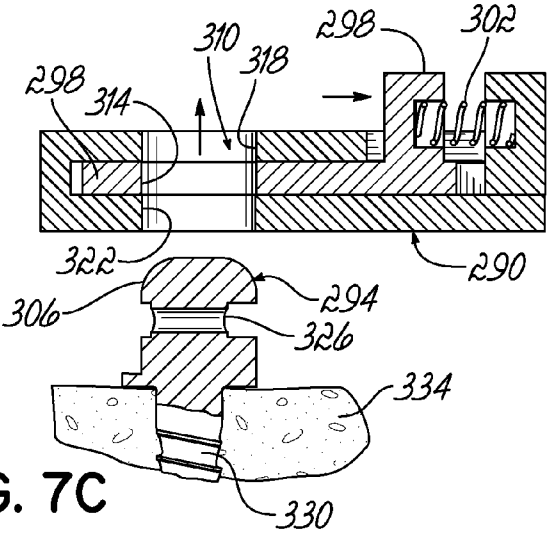

FIG. 7C

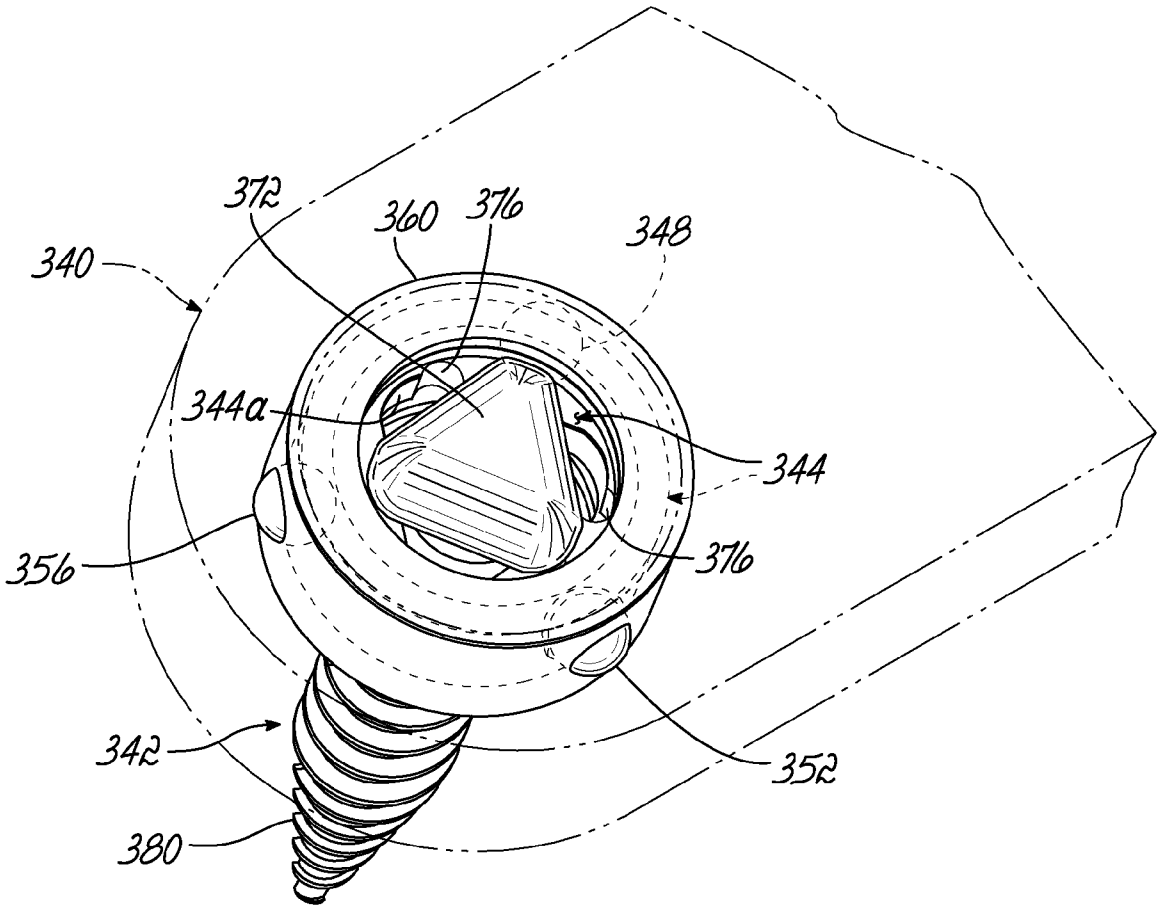

FIG. 8A

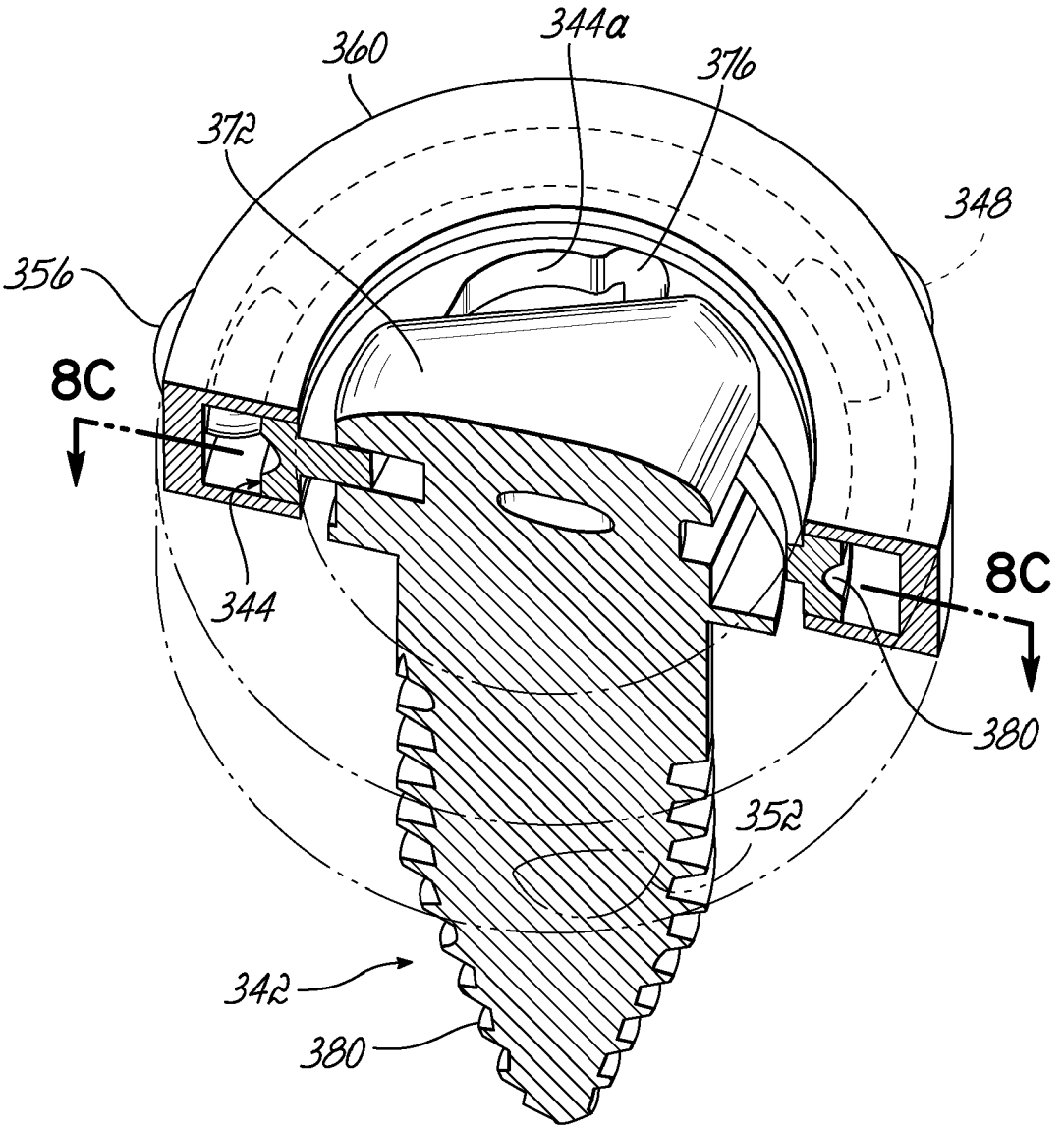

FIG. 8B

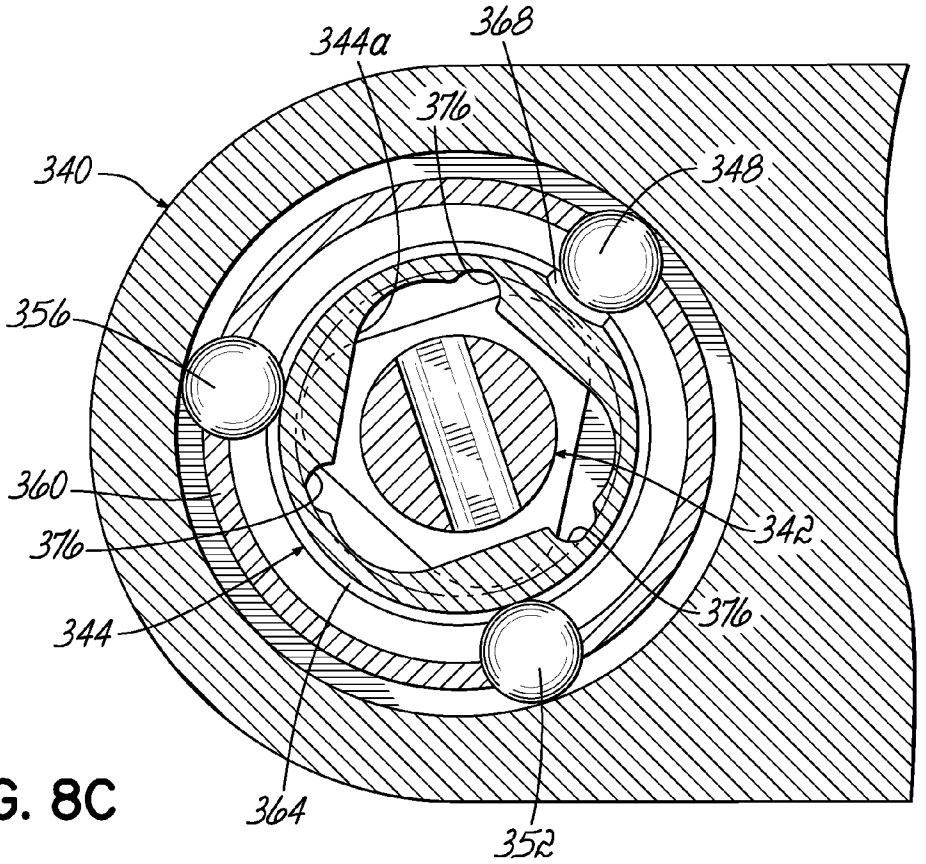
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FIG. 8C

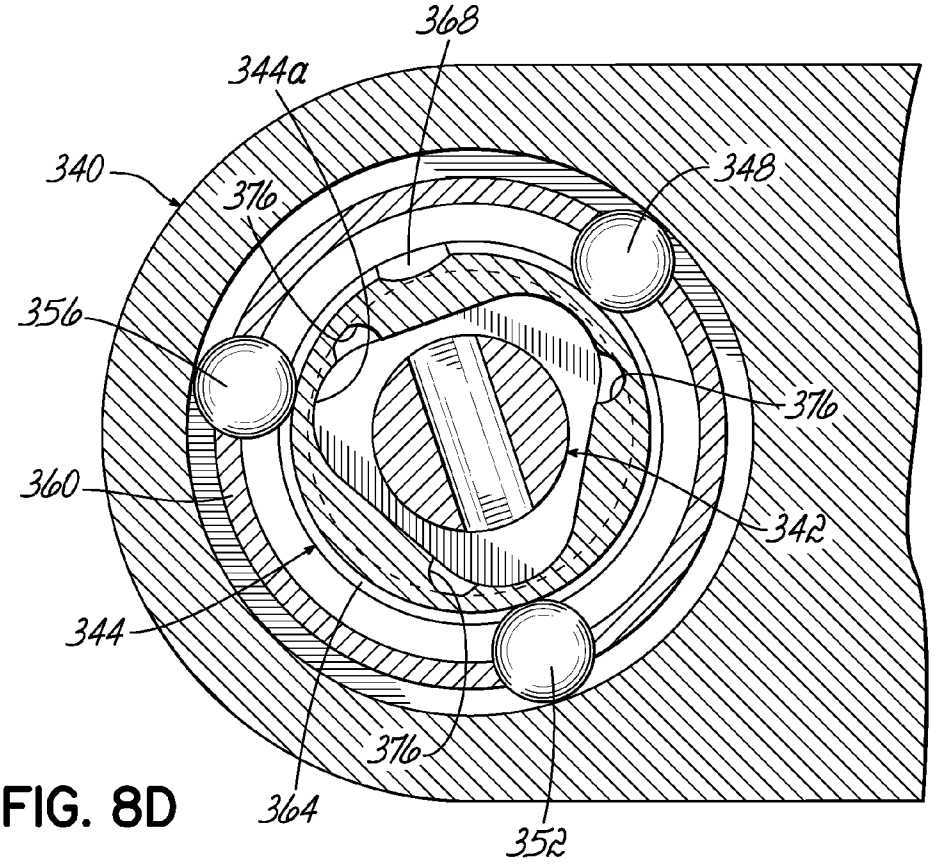
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FIG. 8D

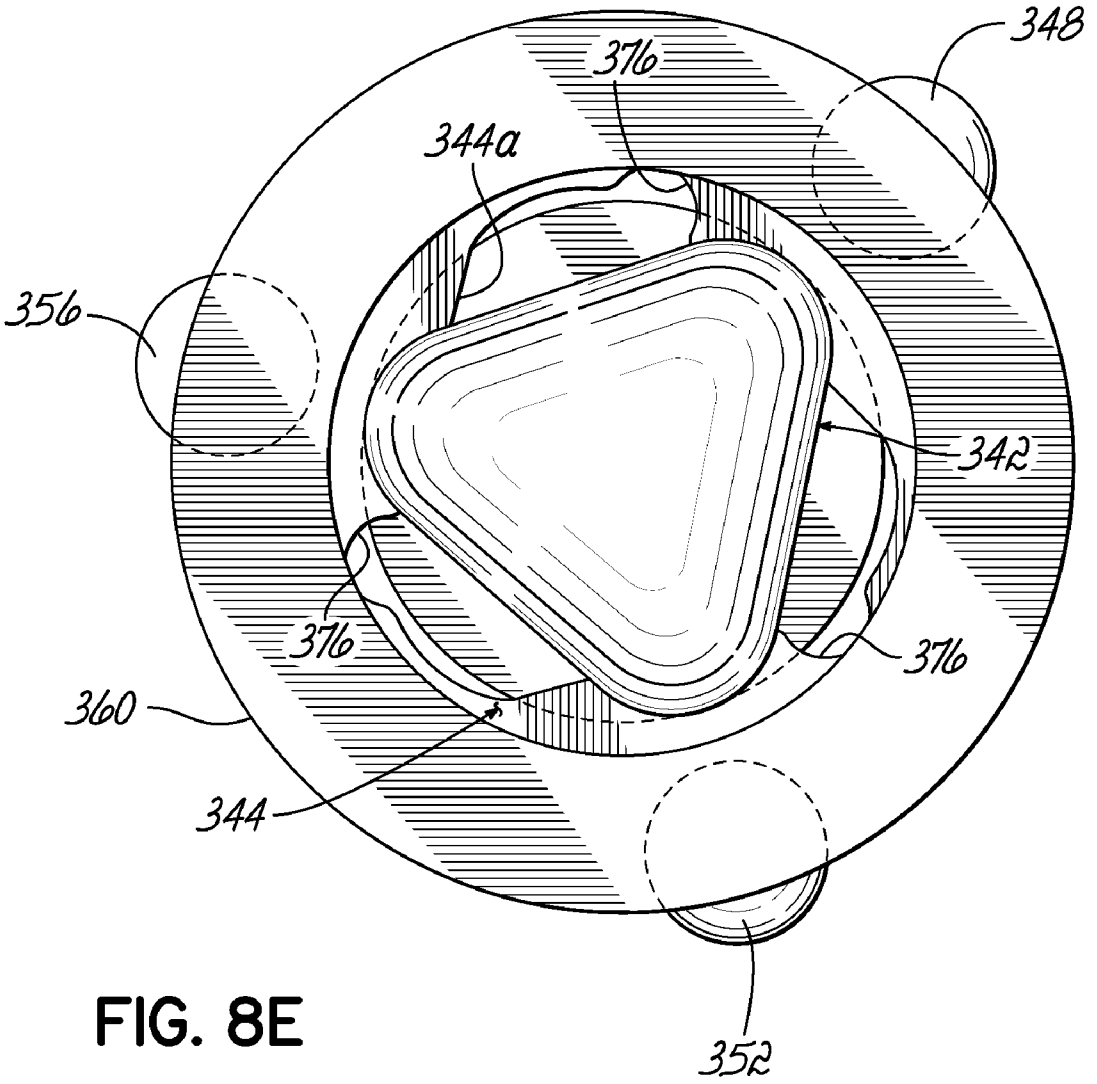

FIG. 8E

SCREW ANCHORED ORTHODONTIC APPLIANCE AND METHODS

[0001] This application claims the priority of U.S. Provisional Patent Application Ser. No. 61/019,388, filed on Jan. 7, 2008 (pending), the disclosure of which is incorporated by reference herein.

TECHNICAL FIELD

[0002] The present invention generally relates to orthodontic appliances for correcting malocclusions and, more specifically, orthodontic appliances configured to be anchored using screw implants.

BACKGROUND

[0003] There are currently several different types of orthodontic appliances that are designed to correct malocclusions in patients. One primary challenge of these appliances relates to the fact that most are designed to be attached to the patient's teeth. Therefore, even if the clinician is attempting to correct the malocclusion by using a "skeletal" correction, such as a palatal expansion, one or more teeth may be unintentionally displaced relative to the skeletal structure during the process. In other cases, the clinician may desire to correct the malocclusion by moving one or more specific teeth, such as in a molar distalization procedure, and unintentionally displace other teeth in the process.

[0004] As an attempt to overcome these challenges, orthodontists have recently started using mini-screws in conjunction with these appliances. The goal is to anchor the appliance and cause less unintended tooth movement. A disadvantage of this approach is that the orthodontist or clinician typically places the appliance first and then uses a mini-screw driven into the patient's skeletal structure or osseous tissue to secure the appliance in place. If the clinician needs to remove the appliance prior to completion of treatment, such as due to appliance breakage or the need for cleaning or adjustment, the clinician must first remove the mini-screw. However, when the appliance is then replaced in the patient, the original screw hole in the bone may be compromised and the screw may loosen. To overcome this problem, the clinician could use a new location for the screw but doing so would require relocating the screw hole or eyelet in the appliance as well.

SUMMARY

[0005] The present invention generally provides an orthodontic appliance and method for attaching and removing the appliance in manners that address the challenges in this area. Generally, the orthodontic appliance may comprise a device including first and second operating components. At least one of the operating components is configured to be coupled to at least one tooth of a patient. The operating components are coupled together in a manner allowing controlled movement of at least one of the operating components for purposes of correcting the malocclusion. A connector element including an eyelet coupled to at least one of the first or second operating components is configured to be coupled with an orthodontic screw. The orthodontic screw is configured to be received by the eyelet and includes a threaded portion for implantation into the patient, and a screw head. The head is movable between a locked position and an unlocked position. This movement may be of the entire head or only one or more portions thereof. In the locked position the connector element is locked to the head and in the unlocked position the connector element may be removed from the head while the threaded portion remains implanted in skeletal structure of the patient.

[0006] The first and second operating components, for example, may form part of a palatal expansion device, a molar distalization device, or another orthodontic appliance for treating a malocclusion. The eyelet of the connector element and the head of the screw may have corresponding geometric shapes, such as triangular shapes or other polygonal shapes. In one embodiment, the head may be rotated from the locked position to the unlocked position. This rotation may occur together with rotation of the threaded portion or not. Another option is to have the head removable from the threaded portion. It will be appreciated that many different shapes for the eyelet and the screw head may be utilized and that the eyelet and screw head do not necessarily have to be corresponding in shape.

[0007] In another embodiment, an orthodontic appliance is provided for correcting malocclusions including a device with first and second operating components. At least one of the operating components is configured to be coupled to at least one tooth of a patient. The operating components are coupled together in a manner allowing controlled movement of at least one of the operating components for purposes of correcting the malocclusion. A connector element includes an eyelet coupled to at least one of the first or second operating components. At least a portion of the connector element is movable between locked and unlocked positions. An orthodontic screw includes a threaded portion and a head. The head is retained in the eyelet in the locked position and is removable from the eyelet in the unlocked position while the threaded portion remains implanted in skeletal structure of a patient. As with all embodiments, the first and second operating components may, for example, be part of a palatal expansion device or molar distalization device and the eyelet and the head may have corresponding geometric shapes, such as triangular shapes. In this embodiment, at least the portion of the connector element may be rotated from the locked position to the unlocked position or, for example, may be moved in a linear manner. A biasing structure may be provided in these embodiments, for example, to assist with retaining the locked and/or unlocked positions.

[0008] A method that is provided herein of attaching an orthodontic appliance to a patient, may comprise implanting a threaded portion of at least one orthodontic screw in skeletal structure of the patient. The orthodontic screw is retained with respect to an eyelet of the orthodontic appliance using a head of the orthodontic screw in a locked position relative to the eyelet. To then remove the orthodontic appliance, at least one of the head or the eyelet is moved from the locked position to an unlocked position. This allows the eyelet to be removed from the orthodontic screw while the threaded portion remains implanted in the skeletal structure of the patient. Other features of the method, and the various embodiments disclosed herein will become more apparent from a review of the description of the various embodiments and their method of implantation and removal.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a perspective view illustrating an appliance constructed in accordance with a first embodiment and connected with respect to the mouth and teeth of a patient.

[0010] FIGS. **1**A, **1**B and **1**C are perspective views of a connector element and screw of the appliance shown in FIG. **1**, with the screw successively moving between a locked position and an unlocked position suitable for removing the connector element or eyelet.

[0011] FIG. **2** is a perspective view of another embodiment of an appliance connected to the teeth and palate of a patient.

[0012] FIGS. **2**A, **2**B and **2**C are perspective views of a screw and connector element or eyelet successively showing the screw in locked and unlocked positions, similar to FIGS. **1**A, **1**B and **1**C.

[0013] FIG. **3**A is a disassembled perspective view of another embodiment of a screw constructed to allow removal of an orthodontic appliance without removing the implanted screw.

[0014] FIG. **3**B is a disassembled elevational view of the screw shown in FIG. **3**A, and additionally showing a connector element of an orthodontic appliance.

[0015] FIGS. **3**C and **3**D are respective longitudinal cross sectional views of the screw and connector element shown in FIG. **3**B and respectively showing locked and unlocked positions of the screw head relative to the threaded portion of the screw.

[0016] FIG. **4** is a perspective view of a connector element of an orthodontic appliance coupled with a screw in accordance with another embodiment.

[0017] FIG. **4**A is a top view of the connector element and screw shown in FIG. **4** and schematically illustrating the movement of the eyelet or connector element between locked and unlocked positions.

[0018] FIG. **5**A is a perspective view of an orthodontic screw with a head that is movable between locked and unlocked positions by way of biased or resilient compression.

[0019] FIG. **5**B is a top view of the screw shown in FIG. **5**A, but also showing a connector element mounted to the screw head.

[0020] FIG. **5**C is a perspective view similar to FIG. **5**A, but illustrating the application of a connector element associated with an orthodontic appliance.

[0021] FIG. **6** is a perspective view of another embodiment of an orthodontic screw in which the screw head is independently rotatable.

[0022] FIG. **6**A is a perspective view of the screw shown in FIG. **6**, and further illustrating removal of the head.

[0023] FIG. **6**B is a perspective view of the orthodontic screw shown in FIG. **6**A with the head removed.

[0024] FIG. **6**C is a bottom view of the screw head showing the recesses used to register the six different angular or rotational positions of the screw head.

[0025] FIGS. **6**D, **6**E and **6**F are similar to FIG. **6**C, but successively illustrate rotation of the screw head with respect to the threaded portion of the screw between two of six different positions.

[0026] FIG. **7** is a perspective view of another embodiment illustrating an alternative connector element for releasably securing an orthodontic screw to an orthodontic appliance.

[0027] FIG. **7**A is a top view of the connector element and screw shown in FIG. **7**.

[0028] FIGS. **7**B and **7**C are cross sectional views illustrating the connector element in respective locked and unlocked positions relative to the screw head.

[0029] FIG. **8**A is a perspective view showing an alternative embodiment of a connector element coupled with an orthodontic screw.

[0030] FIG. **8**B is a perspective view of the connector element and orthodontic screw shown in FIG. **8**A in longitudinal cross section.

[0031] FIG. **8**C is a cross sectional view taken along line **8**C-**8**C of FIG. **8**B, and illustrating the connector element in a locked position to retain the connector element on the screw.

[0032] FIG. **8**D is a cross sectional view similar to FIG. **8**C, but illustrating the connector element rotated to an unlocked position allowing removal thereof from the screw head.

[0033] FIG. **8**E is a top view of the screw and a portion of the connector element shown in FIG. **8**A, illustrated in the locked position.

DETAILED DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENTS

[0034] FIGS. **1** and **1**A through **1**C illustrate an orthodontic appliance in the form of a palatal expansion device **10** constructed in accordance with one illustrative embodiment of the invention. Specifically, a main body portion **12** of the palatal expansion device is generally conventional in structure and includes a screw activation mechanism **14** and a pair of operating components **16**, **18**. A custom made coupling element **20** secures one side of the device **10** to teeth **22** of the patient. The opposite side of the device **10** includes a pair of eyelets **30**, **32**. The eyelets **30**, **32** are formed with triangular holes **30***a*, **32***a* that correspond in shape to triangular heads **40***a*, **42***a* of a pair of respective mini-screws **40**, **42**. Threaded portions of the mini-screws **40**, **42** such as shown in embodiments described below are first implanted in the palatal bone or skeletal structure of the patient and each screw head **40***a*, **42***a* is turned so that it aligns with the respective holes **30***a*, **32***a* of the eyelets **30**, **32** as shown for the upper screw head **40***a* and eyelet hole **30***a* in FIG. **1** and the lower screw head **42***a* as shown in FIG. **1**B. FIG. **1** illustrates that the lower implant screw **42** has been rotated approximately 60° into a locked position in which the screw head **42***a* is misaligned with the hole **32***a* of the eyelet **32** and, therefore, the eyelet is locked against removal. When the upper screw head **40***a* is rotated in the same manner, both mini-screws **40**, **42** will be in locked positions and the expansion device **10** will be retained in place and may then be used to expand the palate of the patient by rotating the activation mechanism **14** in a known manner.

[0035] FIGS. **1**A through **1**C illustrate the successive steps involved in removing the appliance **10**. That is, the screw head **42***a* is rotated approximately 60° from the locked position shown in FIG. **1**A to the unlocked position shown in FIG. **1**B. At this point, the screw head **42***a* is aligned with the triangular shaped hole **32***a* of the eyelet **32**. The same procedure is used to align the screw head **40***a* with the eyelet hole **30***a*. The appliance **10** may then be moved in a linear fashion directly off of the mini-screws **40**, **42** as shown in FIG. **1**C. When it is desired to replace the appliance **10** in the patient, the eyelets **30**, **32** may simply be inserted over and past the screw heads **40***a*, **42***a* and the screw heads **40***a*, **42***a* may then be rotated through a partial rotation to the locked position as previously described.

[0036] FIGS. **2** and **2**A through **2**C illustrate a portion of an orthodontic appliance in the form of a molar distalization device **100** that is constructed in a known manner, except for the incorporation of a mini-screw **102** and eyelet **104** having an opening **104***a* constructed in accordance with an illustrative embodiment of the invention. This mini-screw **102** and attached screw head **102***a*, as well as the eyelet **104** and its

opening **104***a* are constructed in the manner previously described in connection with FIGS. **1** and **1**A through **1**C. In this example, approximately one-half of the distalization device **100** is shown and includes a band **110** encircling a molar tooth **112** of the patient and including a connecting element **114** welded thereto. The remaining half of the device **100** may be similarly designed and configured or may take any other suitable configuration. Together, the band **110** and the connecting element **114** comprise one operating component movable relative to another operating component **116** to "distalize" the molar or, in other words, move the molar in a distal direction. In a known manner, a spring **120** is used to apply a bias between the two operating components and a screw adjustment element **130** may be used to apply more or less distalization force. An elastic band **132** may be coupled generally between the screw adjustment element **130** and the band. A mid-section **136** of the appliance or device **100** is welded or otherwise rigidly secured to the eyelet **104**. In this manner the central portion of the device **100** may be anchored to the patient's palatal bone structure using the mini-screw **102**.

[0037] As with the embodiment described in connection with FIGS. **1** and **1**A through **1**C, the distalization device **100** is applied to the patient by first implanting the mini-screw **102** in the palatal bone structure of the patient, for example, such that the screw head **102***a* is rotated to an unlocked orientation or position, as shown in FIG. **2**B. The device **100** is then installed by moving the eyelet hole **104***a* into alignment with the screw head **102***a*, and then over and past the screw head **102***a*. The screw head **102***a* is then "locked" relative to the eyelet **104** by a partial rotation, such as a "quarter turn" or, in this example, a partial rotation of approximately 60° as illustrated in FIG. **2**. The remaining portions of the device or appliance **100** may then be secured to the patient in a known manner. To remove the device **100**, the screw head **102***a* is partially rotated as shown in the progression of FIGS. **2**A and **2**B and the device **100** may then be lifted or moved off of the mini-screw as shown in FIG. **2**C.

[0038] FIGS. **3**A, **3**B, **3**C and **3**D illustrate an alternative embodiment of an orthodontic screw **150** for releasable coupling or connection with a connector element **154** of an orthodontic appliance (not shown). It will be appreciated that, with respect to this embodiment as well as those to be described below, the entire orthodontic appliance is not shown as it may be of known or conventional construction and configuration, such as those previously shown. The connector elements shown herein may also be changed in design while still retaining the general features to be discussed herein with regard to the ability to detach the connector element and, therefore, the orthodontic appliance from the patient without removing the threaded portion of the orthodontic screw or screws being used to attach the appliance to skeletal structure the patient. In this embodiment, the head **158**, or at least a portion of the head **158**, is connected to the threaded body **162** of the screw **150** in a locked but releasable manner. In this regard, the head portion **158** includes two connection arms **158***a*, **158***b* that may be resiliently compressed toward one another under a biasing force as shown in FIG. **3**D. This allows insertion of a hex portion **160** the screw head portion **158** into a mating hex receptacle **166** at the top of the screw body **162**. As the screw head portion **158** is inserted downwardly within the receptacle **166**, the arms **158***a*, **158***b* will resiliently squeeze or compress together as they pass a flange **170** (FIG. **3**C) and, once past the flange **170**, the arms **158***a*, **158***b* will spring back radially outwardly and be retained in respective slots **174***a*, **174***b* of the body **162**. In this manner, the connector element **154** of the orthodontic appliance may be retained between an upper flange **178** of the screw head portion **158** and an upper surface **162***a* of the screw body **162** as shown in FIG. **3**C. The slots **174***a*, **174***b* may receive a tool (not shown) for squeezing the arms **158***a*, **158***b* radially inward as shown in FIG. **3**D thereby allow the arms **158***a*, **158***b* to pass through the central hole **182** created by the flange **170**. Another tool (not shown) may be used to grasp the protrusion **186** at the top of the screw head portion **158** to pull the screw head portion **158** out from the body **162** allowing removal of the connector element **154** and, therefore, an orthodontic appliance associated therewith.

[0039] FIGS. **4** and **4**A illustrate another alternative embodiment in which a connector element **190** associated with an orthodontic appliance (not shown) may be activated between locked and unlocked positions relative to an orthodontic screw **194** having a screw head **198**. In this regard, a tool **202** may be used to engage a pair of holes **206***a*, **206***b* or other tool engagement structure associated with a rotatable member **210** of the connector element **190**. The rotatable member **210** may be rotated between the locked position shown in FIGS. **4** and **4**A in which the triangular shaped head **198** is misaligned with the triangular shaped opening or hole **214** of the rotatable member **210**. A set screw **218** is tightened against the rotatable member **210** to further establish the locked position. It will be appreciated that any other suitable locking element may be used in place of the set screw **218**. One other possibility, for example, is a spring-loaded plunger element that would selectively engage the rotatable member **210** to prevent rotation. With the set screw **218** loosened, the rotatable member **210** may be rotated to the unlocked position shown in dashed lines of FIG. **4**A such that the triangular shaped screw head **198** is aligned with the triangular shaped hole **214**. This allows the connector element to be removed from the orthodontic screw **194** while a threaded portion (not shown) of the screw **194** remains implanted.

[0040] FIGS. **5**A, **5**B and **5**C illustrate another alternative embodiment of an orthodontic screw **230** having a head **234** that may be moved between locked and unlocked positions. In particular, the screw head **234** includes first and second portions **234***a*, **234***b* that may be resiliently squeezed or compressed together using a suitable tool **238**, for example, to allow removal of a connector element **242** associated with an orthodontic appliance. The connector element **242** may be placed onto the orthodontic screw head **234** and surfaces of the screw head **234** itself may provide a camming action such that, as the triangular shaped hole **242***a* of the connector element **242** is pushed onto the head **234**, the first and second portions **234***a*, **234***b* squeeze or compress together until the connector element **242** passes the triangular shaped head **234** and registers with a recess or undercut **248**. At this point, the first and second head portions **234***a*, **234***b* expand outwardly under a bias and are retained on an opposite side of the connector element **242**. In this regard, the dimensions of the triangular shaped screw head **234** in its expanded, normal state are greater than the triangular dimension of the hole **242***a* in the connector element **242**. When removal of the connector element **242** and any associated orthodontic appliance is desired, the tool **238** may be used to squeeze the head portions **234***a*, **234***b* together to a smaller dimension allowing the triangular shaped screw head **234** to pass through the triangular shaped hole **242***a* in the connector element **242**. In

this manner, the orthodontic appliance may be removed from the patient and replaced, for example, without removing the threaded portion **246** of the screw implant **230** from the skeletal structure of the patient.

[0041] FIGS. **6** and **6**A-**6**F illustrate another embodiment of an orthodontic screw **250** in which the screw head **254** may be rotated relative to the threaded portion **258** of the screw **250** in order to achieve locked and unlocked positions relative to a connector element **262** having a correspondingly shaped hole or eyelet, such as those illustrated in FIGS. **1** and **2**. In this embodiment, as shown in FIG. **6**A, the screw head **254** may be attached to the threaded portion **258** of the screw **250** by way of a clip **270**. At the top of the threaded portion **258**, three arms **274**, **278**, **282** are provided that may be forced radially inward against a bias, for example, provided by the characteristics of the material used to form the threaded body portion **258**. For example, this material may be titanium. In top view, as illustrated in FIGS. **6**D-**6**F, the arms **274**, **278**, **282** have protrusions **274***a*, **278***a*, **282***a* extending radially outward. These three respective protrusions **274***a*, **278***a*, **282***a* may register with respective recesses **254***a-f* provided within the screw head **254**. The attachment of the screw head **254** to the threaded body **258** by way of the clip **270** being received in a recess **286** allows the head **254** to be rotated with respect to the body **258**. As the head **254** is rotated, the respective recesses **254***a-f* rotate with respect to the protrusions **274***a*, **278***a*, **282***a* on the arms **274**, **278**, **282** allowing the head **254** to snap into any one of six different rotational positions relative to the threaded portion or body **258** and the arms **274**, **278**, **282**. As the head **254** is rotated, the arms **274**, **278**, **282** resiliently squeeze or compress radially inward as shown in FIG. **6**E as each of the protrusions **274***a*, **278***a*, **282***a* passes respective protrusions **254***g-l* between the recesses **254***a-f* within the screw head **254**. In this manner, the screw head **254** may be rotated between locked and unlocked positions with respect to the threaded body **258** such that, for example, the triangular shaped head **254** respectively aligns and misaligns with a triangular shaped hole in an eyelet (FIGS. **1** and **2**). Thus, the head **254** alone may be rotated between a locked position and an unlocked position while the threaded portion **258** of the orthodontic screw **250** does not rotate and remains implanted. When the head **254** is aligned with a correspondingly shaped eyelet, or otherwise moved to an unlocked position, the connector element **262** and associated appliance may be lifted off of the head **254** as previously discussed.

[0042] FIGS. **7** and **7**A-**7**C illustrate another alternative embodiment in which a connector element **290** of an orthodontic appliance (not shown) may be activated between locked and unlocked positions to be respectively retained on and released from an orthodontic screw **294**. In this regard, a movable locking portion **298** of the connector element **290** is normally biased into a locked position by a spring **302**, for example, to retain the head **306** of the screw **294** within an eyelet **310** as shown in FIG. **7**B. In this regard, the movable portion **298** includes a hole **314** that, in the locked position, misaligns with respective additional holes **318**, **322** in the connector element **290** and engages a recess **326** of the head **306**. In this position, shown in FIG. **7**B, the connector element **290** may not be lifted from the screw head **306** since the movable locking portion **298** will engage the upper portion of the screw head **306** and prevent disengagement of the connector element **290** from the screw head **306**. With the movable locking portion **298** moved to the right, as viewed in FIG. **7**C, against the biasing force provided by the spring **302**, the respective holes **314**, **318**, **322** in the connector element **290** align thereby allowing the connector element **290** to be lifted from the screw head **306** while the threaded portion **330** of the screw **294** remains implanted in the skeletal structure **334** of the patient.

[0043] FIGS. **8**A-**8**E illustrate another embodiment similar to the embodiment shown and discussed with regard to FIGS. **4** and **4**A. In this embodiment, the connector element **340** includes a rotatable portion **344** that may be engaged by a suitable tool (not shown) in order to rotate the rotatable portion **344** between locked and unlocked positions relative to an orthodontic implant screw **342** shown respectively in FIGS. **8**C and **8**D. Instead of using a set screw as shown in FIGS. **4** and **4**A, spherical balls **348**, **352**, **356** are used to retain at least the locked position. As shown in FIGS. **8**C and **8**D, the balls **348**, **352**, **256** are trapped between two portions of the connector element **340**, i.e., the inner rotatable portion **344** and an outer, nonrotatable portion **360**. The inner rotatable portion provides a groove **364** within which the balls **348**, **352**, **356** may freely rotate as the inner portion **344** and its associated triangular hole **344***a* rotate about the longitudinal axis of the screw **342**. The inner portion **344** also includes a locking detent **368** in which one of the balls **348** may reside to fix the position in a locked condition as shown in FIG. **8**C. Upon application of suitable rotational force, the recess or detent **368** may be rotated away from the ball **348** into an unlocked position aligning the triangular shaped screw head **372** with the triangular shaped hole **344***a* of the rotatable portion **344**. Rotational force may be applied using a suitable tool (not shown) engaging one or more recesses **376** to rotate the inner portion **344**. This allows the connector element **340** and any associated appliance to be lifted or removed off of the screw head **372** while the threaded portion **380** of the screw remains implanted in the skeletal structure of the patient.

[0044] While the present invention has been illustrated by a description of various preferred embodiments and while these embodiments have been described in some detail, it is not the intention of the Applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. The various features of the invention may be used alone or in any combination depending on the needs and preferences of the user. This has been a description of the present invention, along with the preferred methods of practicing the present invention as currently known. However, the invention itself should only be defined by the appended claims.

What is claimed is:

1. An orthodontic appliance for correcting malocclusions, comprising:

a device including first and second operating components, at least one of the operating components configured to be coupled to at least one tooth of a patient, the operating components being coupled together in a manner allowing controlled movement of at least one of the operating components for purposes of correcting the malocclusion,

a connector element including an eyelet coupled to at least one of the first or second operating components, and

an orthodontic screw including a threaded portion and a head, the head being movable between a locked and unlocked position such that in the locked position the connector element may not be removed from the head and in the unlocked position the connector element may

be removed from the head while the threaded portion remains implanted in skeletal structure of a patient.

2. The appliance of claim **1**, wherein the first and second operating components form part of a palatal expansion device.

3. The appliance of claim **1**, wherein the first and second operating components form part of a molar distalization device.

4. The appliance of claim **1**, wherein the eyelet and the head have corresponding geometric shapes.

5. The appliance of claim **4**, wherein the corresponding geometric shapes are triangular.

6. The appliance of claim **1**, wherein the head may be rotated from the locked position to the unlocked position.

7. The appliance of claim **6**, wherein the head may be rotated relative to the threaded portion.

8. The appliance of claim **7**, wherein the head and the threaded portion are fixed for rotation together relative to the connector element.

9. The appliance of claim **1**, wherein the head is removable from the threaded portion to move the head to the unlocked position.

10. The appliance of claim **9**, wherein the head is removably coupled to the threaded portion with a snap fit.

11. The appliance of claim **1**, wherein at least one portion of the screw may be moved with respect to another portion during movement of the head between the locked and unlocked portions.

12. The appliance of claim **1**, wherein the one portion is moved against a biasing force.

13. An orthodontic appliance for correcting malocclusions, comprising:

a device including first and second operating components, at least one of the operating components configured to be coupled to at least one tooth of a patient, the operating components being coupled together in a manner allowing controlled movement of at least one of the operating components for purposes of correcting the malocclusion,

a connector element including an eyelet coupled to at least one of the first or second operating components, at least a portion of the connector element being movable between locked and unlocked positions, and

an orthodontic screw including a threaded portion and a head, the head being retained in the eyelet in the locked position and removable from the eyelet in the unlocked position while the threaded portion remains implanted in skeletal structure of a patient.

14. The appliance of claim **13**, wherein the first and second operating components form part of a palatal expansion device.

15. The appliance of claim **13**, wherein the first and second operating components form part of a molar distalization device.

16. The appliance of claim **13**, wherein the eyelet and the head have corresponding geometric shapes.

17. The appliance of claim **16**, wherein the corresponding geometric shapes are triangular.

18. The appliance of claim **13**, wherein at least the portion of the connector element may be rotated from the locked position to the unlocked position.

19. The appliance of claim **13**, wherein the connector element includes a biasing structure, and at least the portion of the connector element is movable against a biasing force provided by the biasing structure.

20. The appliance of claim **13**, wherein at least the portion of the connector element may be moved in a linear manner from the locked to the unlocked position.

21. A method of attaching an orthodontic appliance to a patient for correcting a malocclusion, comprising:

implanting a threaded portion of at least one orthodontic screw in skeletal structure of the patient,

retaining the orthodontic screw with respect to an eyelet of the orthodontic appliance using a head of the orthodontic screw in a locked position relative to the eyelet, and

moving at least one of the head or the eyelet from the locked position to an unlocked position allowing the eyelet to be removed from the orthodontic screw while the threaded portion remains implanted in the skeletal structure of the patient.

22. The method of claim **21**, wherein the orthodontic appliance comprises a palatal expansion device.

23. The method of claim **21**, wherein the orthodontic appliance comprises a molar distalization device.

24. The method of claim **21**, wherein moving at least one of the head or the eyelet further comprises:

rotating the head and the threaded portion together.

25. The method of claim **21**, wherein moving at least one of the head or the eyelet further comprises:

moving at least a portion of the head relative to the threaded portion.

26. The method of claim **25**, wherein moving at least one of the head or the eyelet further comprises:

rotating at least a portion of the head relative to the threaded portion.

27. The method of claim **25**, wherein moving at least one of the head or the eyelet further comprises:

removing at least a portion of the head from the threaded portion.

28. The method of claim **21**, wherein the head and the eyelet have corresponding geometric shapes and moving at least one of the head or the eyelet further comprises aligning the corresponding geometric shapes.

29. The method of claim **21**, wherein moving at least one of the head or the eyelet further comprises:

moving at least a portion of the connecting element.

30. The method of claim **29**, wherein moving at least a portion of the connecting element further comprises:

rotating at least a portion of the connecting element.

31. The method of claim **21**, wherein moving at least one of the head or the eyelet further comprises:

moving at least a portion of the connecting element in a linear manner.

32. The method of claim **21**, wherein moving at least one of the head or the eyelet further comprises:

moving at least one of the head or the eyelet against a biasing force.

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